Chapter 3: Francis Galton and the Composite Portrait

> The computer existed as a practice before it existed as a machine.
> Lewis Mumford, "*The Myth of the Machine*"

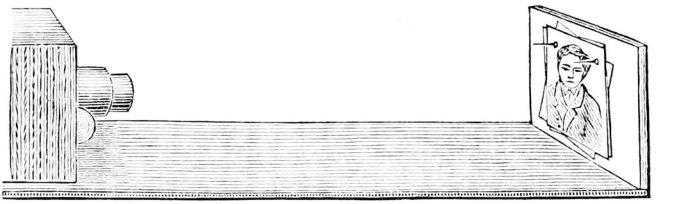
Pictorial Statistics

One of the things that becomes clear once we shift our approach to the eigenface image from treating it as a computational object of study to an object of study in visual culture is that, as an image, it has a history. Just as Peters traces the merging of statistics with a contemporary understanding of information, here I seek to trace the merging of statistics with vision that has occurred through practices of facial recognition. I do so in order to reveal the specific cultural and socio-political contexts in which this merger came about and developed. This approach runs counter to the assumptions of neutrality and objectivity made on behalf of the technology and instead relates the technical processes of facial recognition to discourses concerning representation. In the 1880s, British anthropologist, statistician and founder of the theory of eugenics Francis Galton began experimenting with what he called the composite portrait.[1] Galton's practice of composite portraiture can be under-

1 Galton gave numerous talks on his practice of composite portraiture and published articles in *Nature*. He also described the processes and conclusi-

stood as an antecedent of the representational mechanism used in the eigenface algorithm.[2] The process by which Galton constructed his composites was painstaking – a kind of repetition of acts through which the variance of the human hand could fall away. Galton would stack photographic portraits on top of one another and hang them on the wall in front of the camera (Figure 10).

Figure 10: Francis Galton, "Composites assembled for photography" in Popular Science Monthly Volume 13, (August 1878).

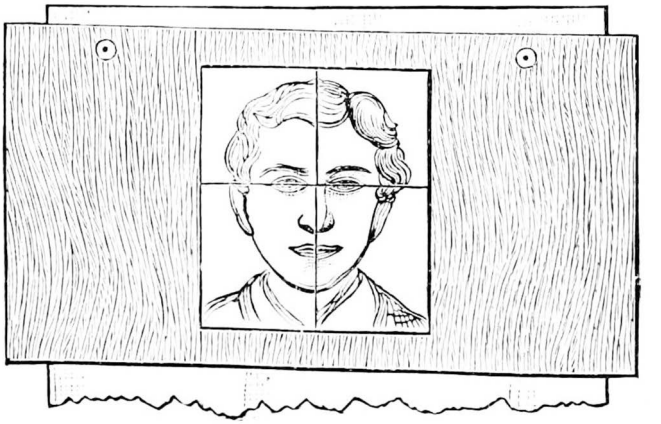


The lighting and scale in each portrait had to be identical, with each face in the same, forward-facing position. Galton made a physical crosshair out of thread, placing it in front of the stack of portraits hanging on the wall. The crosshair ran horizontally through the center of the eyes and vertically through the midline of the face in each image. (Figure 11)

ons of his practice in length in his work *Inquiries into Human Faculty and Its Development*, 2nd ed. (London: Dent, 1907; galton.org 2018), http://galton.org/books/human-faculty/SecondEdition/text/web/human-faculty4.htm.

2 Interestingly, the inventor of PCA was mathematician and biostatistician Karl Pearson, who was a protégé of Francis Galton and was a central early figure in the study of biometry and social evolution. Yet his invention of PCA, in 1901, was unrelated to his studies of social evolution or to Galton's practice of composite portraiture. See Karl Pearson, "LIII. On Lines and Planes of Closest Fit to Systems of Points in Space," *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* 2, no. 11 (1901): 559-72.

Figure 11: Francis Galton, "Step one in assembling a composite photograph" in Popular Science Monthly Volume 13, (August 1878)



He then took a picture of each facial image using a single photographic plate, closing the aperture of the camera in between each shot, when he would turn to the next image in the stack by hand. The result was that he exposed a single photographic plate to all the photographic portraits hanging on the wall. The exposure time for each photograph was calculated as a fraction of the total exposure time for the photographic plate. For example, if there were ten facial images and the photographic plate had to be exposed for a total of a twenty seconds, each facial image would be exposed for two seconds.

Galton originally applied the composite technique to photographs of landscapes to track changes in topography. He approached images of the human face as unknown landscapes. The late nineteenth century witnessed a seemingly inexorable growth in the urban population. Just as the overwhelming scale of the modern state, according to Peters, raised issues of visibility and knowability, so this population growth created a supposed need to recognize certain segments of this population, such as criminals and other "unknowns," in order for them to "be made visible," and this supposed necessity informed Galton's practice. His composite portraits employed statistics in order to visualize that which would

otherwise go unseen; they were a statistical table in pictorial form. Galton stated of his composites that "they are rather the equivalents of those large statistical tables whose totals, divided by the number of cases, and entered in the bottom line, are the averages. They are real generalisations, because they include the whole of the material under consideration."[3] Galton created composites of many sociologically defined groups, including portraits of those who had committed specific crimes, groups of people with particular medical ailments, people from various ethnicities and members of the Jewish population, as well as producing pictures in accordance with idealized categories of beauty and intelligence.

For Galton, the composite's ability to construct representational faces promised a multitude of operational possibilities. Constructing pictures of characteristic physiognomic traits could function as a form of identification and social control. Ultimately, Galton's operation of composite portraits was a failure.[4] Yet the visual practice of composite portraiture and what it reveals continues to be a source of study and allure today for artists, scholars and scientists. There have been numerous studies and analyses of Galton's composite portraits, which testifies to their ability to continue to evoke curiosity and prompt experimentation in many different fields of study. Galton's use of photography made it possible to freeze a visual process of abstraction. In their book *Objectivity*, Lorraine Daston and Peter Galison describe the privileged position of the camera in the history of scientific imagery: "machine-regulated image making was a powerful and polyvalent symbol, fundamental to the new scientific goal of objectivity."[5] As they explain, the use of the camera supported a turn, in the 1830s, toward a scientific "devotion towards depicting what was seen on the surface, not what was deduced or interpreted." Additionally, as a visual apparatus, it held a

3 Galton, *Inquiries*, 233.

4 See Elizabeth Stephens's article on the productive nature of this failure. "Francis Galton's Composite Portraits: The Productive Failure of a Scientific Experiment," unpublished manuscript, June 2013, https://www.researchgate.net/publication/323275029_Francis_Galton's_Composite_Portraits_The_Productive_Failure_of_a_Scientific_Experiment.

5 Daston and Galison, *Objectivity*, 138.

"promise of automaticity" in depiction and perception – much like the perceptual algorithms of the present day – which could produce judgment-free reproductions of physical phenomena. Its machinic abilities were thus equated with a level of authenticity.

Galton describes the composite as depicting a thought process. The advantage of the camera, for Galton, lay in its ability to visually represent the abstracting process of statistics in the form of facial images. With the practice of repetitive exposure, that is, in multiplying the reproduction process by photographing the photograph, Galton's composites transformed the use of the imaging apparatus into a form of statistical measurement. Galton's use of the camera to apply the abstractive process of statistics resulted in a depiction that, as Daston and Galison put it, "passed from individual to group."[6] The use of the camera made it possible to repeatedly reference the same, singular portrait in multiple composites. This aspect also allowed for the application of statistical methods to photographic imagery. It also made it possible to construct an image based on an underlying logic of inductive inference, that is, the act of observing many specific cases in order to discern a pattern and deduce a general idea. For Galton, mechanizing the abstractive procedure through the use of the camera provided a perfect way to merge both apparatuses – the statistical and the photographic – and thus to make abstract phenomena visible, factual and concrete. The pictorial form of the statistical found in the composite photograph made the generalizations these images contained visible not only to Galton but, as he himself noted, to anyone looking at the composite – a collective vision. This feature made the composite image useful for those guided by the ideals of science.[7]

6 Ibid., 170-71.

7 Galton, *Inquiries*, 233.

Zones of Normality

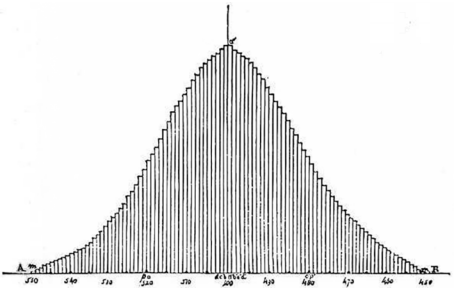
There are two significant influences that have been mentioned in relation to Galton's approach to the production of composite portraits.[8] These influences are the theory of abstraction put forward by the philosopher John Locke and a theory of social statistics of which the Belgian sociologist Adolphe Quetelet was the primary proponent. These two influences are pertinent to an analysis of the logic of recognition and its connection to the eigenface method. Firstly, Galton's approach to composites was based on a desire to create representational faces. His interest in representational faces grew out of a philosophical question about the construction of general ideas that originated in Locke's theory of abstraction. Locke examined this question in relation to language and the formation of words, that is, signs that represent general ideas. Locke claimed that general ideas are formed by the mind separating them out from the particulars of context, time and place, which makes it possible for these ideas to represent more than one individual case. In brief, Locke believed that generalizations can be formed by simply leaving out what is particular to each case. Galton took up this line of thinking in relation to his studies of physiognomy, the "science" of judging a person's character, behavior and personality based on their physical features. Physiognomy often focused on the face as the part of the body that could supposedly reveal behavioral characteristics that lay underneath. Galton applied the theory of abstraction to faces, attempting to create a general face as a sign that could stand for a group. Galton developed his own theory, which he coined "eugenics" – he was the first to use the term – based on a belief in a kind of rascist genetic determinism.

Galton's practice of the composite image was situated within a specific socio-historical context. Allan Sekula describes Galton's work with the composite portrait as grounded in the codified theory of "social statistics," which focuses on social behaviors that can only

8 Thanks to James Conant for discussions about his research into the philosophical underpinnings of Galton's composite portraiture practice.

be observed and identified through statistical means.[9] A central conceptual category in social statistics is that of "the average man,"[10] a notion that comes from Quetelet. Quetelet depicted this concept in the form of a statistical graph, a bell curve in which the average lies at the apex (figure 12). Sekula explains that Quetelet came to regard this pattern as "the mathematical expression of fundamental social law," essentially treating regular occurrence as evidence of a truth.[11] Most importantly, Quetelet defined the central portion of the curve as a "zone of normality" such that deviations too far from the apex would fall into categories of "biosocial pathology" and "monstrosity."[12]

Figure 12: Adolphe Quetelet, "Binomial distribution, 999 trials, histogram," in Lettres sur la theorie des probabilites appliquée aux sciences (Bruxelles, M. Hayez, 1846): 103



Particular social groups of the population were thereby defined as categories through their deviation from the zone of normality. Here we find an origin, based on statistical logic, for the normative categories that define a process of recognition. Sekula describes the formation of the concept of "the average man" as based in part on

9 Robert A. Nisbet, "Social Science," *Encyclopedia Britannica*, September 27, 2018, https://www.britannica.com/topic/social-science/The-20th-century.

10 Allan Sekula, "The Body and the Archive," *October* 39 (Winter 1986): 19. [3-64]

11 Ibid. 22.

12 Ibid. Sekula is here quoting Adolphe Quetelet, *Lettres sur la théorie des probabilities appliquée aux sciences marales et politiques* (Bruxelles: M. Hayez, 1846).

aesthetic values, borrowing from "art historical evidence of noble Grecian foreheads" and a "racist geometrical fiction."[13]

Deviations from a norm created another set of sociological categories. Particular medical ailments and criminal behaviors were societal deviations from a norm, and, as part of his eugenics project, Galton wanted to relate typical cases of these to sociological theories of heredity. The eugenics project was taken to its eventual extreme in its ideological and genocidal adoption by the Nazi regime in Germany. As part of an attempt to construct a cultural aesthetic for the regime, the Nazis' infamous art exhibition "Degenerative Art" was held in Munich in 1937, exhibiting pieces of modern art, including works of expressionism and cubism – what Hitler referred to as "the isms." Along with the exhibition, a catalogue was printed. The basis for this catalogue was a book by Paul Schultze-Naumburg titled, "Kunst und Rasse" (Art and Race).[14] Schultze-Naumburg's book exemplified how the relationship between aestheticized sociological norms and their deviations can be depicted through art. It included photographic portraits of individuals with degenerative medical ailments that left them with deformed faces. These were placed side by side with modernist, painted portraits. Works by Karl Schmidt-Rottluff, Otto Dix and Amedeo Modigliani served as examples that looked akin to photographic portraits of disfigured faces. This stereoscopic comparison between photographs and paintings was utilized to associate modernist art with deviant societal behavior and ill-health in the human population, essentially accusing modernist art itself of being a sociological deviation. The Nazis interpreted the paintings as direct illustrations of a person's physical, surface deformities, rather than expressions of the subjective emotional states of the artists. The coupling of these works expresses an interesting juxtaposition between two types of image production: the expressiveness of the artist and the mechanical precision of photography. Both provided the Nazis with expressions of supposed deviations from a norm or ideal. Quetelet's statistical-

13 Sekula, "Body and the Archive," 22.

14 Schultze-Naumburg, Paul. Kunst und Rasse, Munich, New York: J.F. Lehmanns Verlag, 1928.

ly based concept of a sociological norm provided the justification for the notion of deviation. In opposition to this "degeneration" in both art and the human race, the Nazis preferred the "great" German artworks, filled with pieces capturing the physical ideals of the "Aryan" race. This provides an extreme example in which the categories set out in social statistics theory constructed a notion of modern identity.

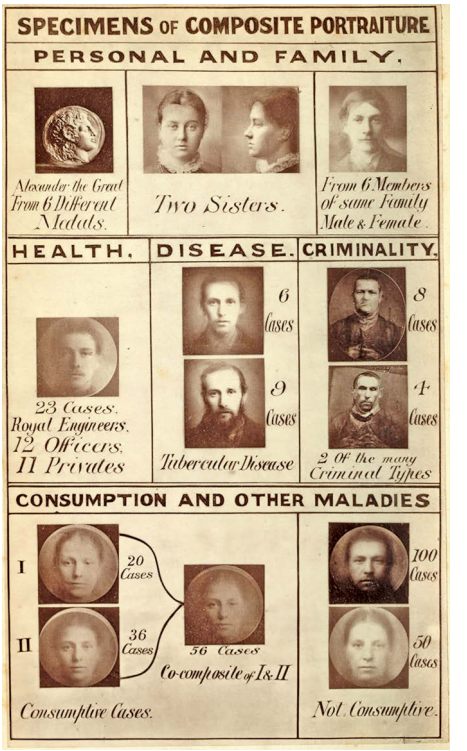
Both the theory of abstraction and social statistics influenced Galton's descriptions and perceptions of the "type" that emerged from the layers of his composite portrait. The significance of the composite portrait, for Galton, lay in its ability to depict what is statistically salient, the "type." Galton described his composites as a "portrait of a type and not of an individual […] an imaginary figure possessing the average features of any given group."[15] As Sekula points out, "type" and "typicality" were words used by Quetelet and closely tied to his application of statistics and the promise of sociological truth. The word "typical" expresses the same idea as the word "generic," with the latter presupposing the existence of a genus. Galton described a type as "a collection of individuals who have much in common and among whom medium characteristics are very much more frequent than extreme ones."[16] Galton gathered faces for the composites based on what he believed to be common physical traits among a group of persons, and these groups, in turn, were based on his own sociologically constructed categories of ethnicity, race, medical or criminal history and social status. The resulting composites were a way for Galton to visually represent the general norm among these groupings such that the particularities of each individual would fall away. Galton described his own perception of the composites as follows: "All that is common remains, all that is individual tends to disappear."[17] In this way, the type functioned for Galton as the word functioned in the formation of language in Locke's theory of abstraction: the typical face stands in as a general sign for multiple faces of the same group (Figure 13).

15 Galton, *Inquiries*, 222.

16 Ibid., 230.

17 Ibid.

Figure 13: Francis Galton, Composite Portraiture, 1883



Thus, for Galton, the particular instances faded into the blur of the image:

> Those of its outlines are sharpest and darkest that are common to the largest number of the components: the purely individual peculiarities leave little or no visible trace. The latter being necessarily disposed equally on both sides of the average, the outline of the composite is the average of all components.[18]

In this description we can hear Galton adopting much the same approach to interpreting his image as Quetelet did to his graph of the "average man" and the corresponding "zone of normality." Like Gal-

18 Ibid., 223.

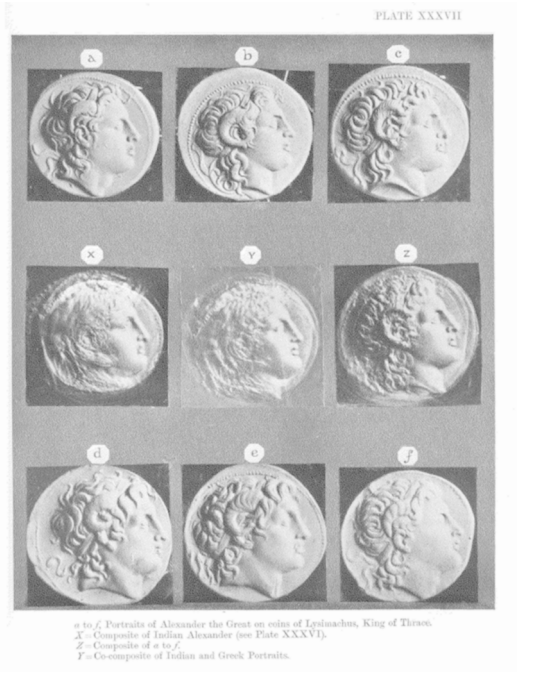
ton's composite, the pinnacle of the bell curve in Quetelet's graph is where clarity and statistical salience lies, with its height depicting the mean. The center of the composite portrait is, for Galton, the significant part of the image. Just as Quetelet had described how, "on both sides of the average," the individual instances decrease and fade, so, for Galton, on all sides of the center of the composite, the particularities fade. At the center of both the graph and the photographic composite you have what is considered by Galton to be a clear impression of commonality, whereas the extremes or deviations from that commonality fade out from the center. The statistically salient "type" is perceived as a visible space in which there is "agreement" and where all the "irregularities disappear, and the common prevails."[19] The "type" seen at this central mean is able to transcend the blurriness of particulars – all that is rendered ungraspable and unseen by excessive variation – and rise above as a representative face, a face that is able to clearly stand for the characteristics of a given group and, as Galton so succinctly observes, "erase the ghostly blur of difference."

Galton describes the type not as something that is perceived on the surface of the image but rather as something that becomes visible, from beneath the layers of faces, through a process of perceptual emergence. This perceptual emergence was facilitated by certain aesthetic factors with which Galton experimented. For example, he observed that composites are best seen in miniature. In a smaller format, the type may more easily be perceived by an observer. One of the more ambitious aspects of Galton's composite portraiture was his use of the photographic medium – a medium grounded in indexical meaning – for the purpose of producing a representation of a face that does not exist in physical reality. Galton's production of the composite utilized the photographic medium to produce a model. The process of repetitive exposure in Galton's composite portraiture transformed the photographic apparatus into a kind of statistical measuring device. The emergence of a perceivable "type" materialized a distinct figure of the imagination on the basis of which it is possible to recognize individual members of the group.

19 Ibid., 224.

Thus, this photographic construction of a type is an early antecedent of the virtual models used in AFR technology.

Figure 14: Francis Galton, "Indian Portraits of Alexander the Great with Composite in centre" in Karl Pearson, The Life, Letters and Labours of Francis Galton Vol 2, 1924: 296



A Sociological Ideal

Galton's composite image was not only a depiction of a statistical norm. It was also invested with the notion of an ideal form. For Quetelet, the average man was not only a type but also a sociological ideal. Galton's first composite portrait is indicative of this desire for an ideal; it was constructed not from photographs but rather from a collection of medallions featuring the head of Alexander the Great (figure 14). Galton took six separate medallions carved by different

artists and created a composite from photographic images of each of them. He explained that each medallion contained individual faults caused by the artist's mistakes, but, once composited, all these mistakes fell away, leaving a "pure," idealized representation of Alexander the Great. Galton later applied this same desire for an ideal to produce composites reflecting norms of intelligence and of feminine beauty (the latter made up, exclusively of young white women).

Galton's most well-known composites were of criminals. Criminal portraiture, with its consistent format, provided an ideal source for composite production. A composite Galton made of the "violent criminal" type (figure 15) provided him with an opportunity for deeper reflection on the composite's ability to produce an ideal. He stated:

> It will be observed that the features of composites are much better looking than those of the components. The special villainous irregularities in the latter have disappeared and the common humanity that underlies them has prevailed. They represent not the criminal, but the man who is liable to fall into crime.[20]

Galton's goal was to produce a generalization that would depict the features of a violent criminal, but instead he saw an ideal, a face devoid of what he understood to be criminal features. Instead, he took the composite to depict what a man looks like before he commits the violent act. Galton supposed that the irregularities linked with deviation from a norm had faded from the image, taking with them the deviant characteristics of the criminal. The criminal composite projected, rather, a temporal reversal: that is, the face of a criminal before the crime. This was an early recognition of the preemptive and predicative capacity of the composite, statistical form.

20 Ibid.

Figure 15: Francis Galton, Frontispiece for Havelock Ellis, The Criminal, (New York: Scribner & Welford, 1890)

The connection between AFR technology and historical practices of recognition has been noticed by a few contemporary scholars. In this context, mention is often made of the work of Alphonse Bertillon[21] and his system of recognition within criminology. For example, Kelly Gates relates contemporary AFR systems to Bertillon's work on the basis of an underlying "individualizing logic" that has, as its

21 Alphonse Bertillon (1853-1914) was a Parisian police official who developed an anthropometrically based identification system for tracking recidivism in criminals.

aim, "to identify individual faces rather than facial types."[22] While it is true that the eigenface method, along with all contemporary automated systems of facial recognition, aims to recognize the individual and not the type, I focus rather on the shared logic of recognition present in Galton's composite portraits and the eigenface method, a logic based on a reductive and statistical way of seeing. The analogy between Galton's approach and the eigenface method is brought home when one sees eigenpictures with captions such as "the average man" in journal articles on the method's development. We may also detect an echo of Galton's process of making a composite in Sirovich and Kirby's description of the process of building a training set. Most importantly, the same process of reduction that occurs in Galton's perception of the composite is utilized as a representational mechanism in eigenface.

As I have explained, Galton's composite images made it possible to perceive the characteristics of an individual to pass into the group. Through the recognition process of eigenface and the function of the eigenvector, the characteristics of the individual are extracted from the group. Both occurrences of recognition rely on a composite form; in the eigenface algorithm, this is manifested as the eigenvector, which functions as the primary referent for recognition. Individuals are recognized (or not) based on their deviation from an average, that is, the eigenvector. Although eigenface is not used to produce and recognize a type, this classifying logic lives on as a "ghost in the machine." Built into the representational mechanism of eigenface is the ability to recognize individuals in virtue of the degree to which they deviate from a norm.[23] In the example of Galton's composite portraits, part of his broader theory of eugenics, we can see the particular cultural and historical context behind the merging of statistics and visual perception we find in the logic of eigenface.

22 Gates, *Our Biometric Future*, 20.

23 See further discussion on this in Chapter 9: Conclusion, p. 182.